Contribution ID: **112** Type: **oral presentation**

Cyclotron production of Sc-44 - new radionuclide for PET technique

Thursday 22 September 2011 16:50 (15 minutes)

Objectives: Two isotopes of scandium, 47Sc and 44Sc, are perspective radionuclides respectively for radiotherapy and diagnostic imaging. 47Sc decays with the half-life of 3.35 days and maximum β- energy of 600 keV. It also emits low-energy γ-radiation (Eγ = 159 keV) suitable for simultaneous imaging. The other scandium radionuclide, 44Sc (t1/2 = 3.92h) is an ideal β+-emitter in PET diagnosis. It can be used as an alternative to 68Ga, because 44Sc has longer half-life and forms stable radiobioconjugates with a structure similar to 90Y and 177Lu, that is important in planning radionuclide therapy [1]. 44Sc can be obtained as a daughter radionuclide of long-lived 44Ti (t1/2 = 60.4y) from 44Ti/44Sc generator or can be produced by nuclear reaction 44Ca(p, n)44Sc in small cyclotrons. The aim of our work was to find optimal parameters for 44CaCO3 target irradiation in order to maximize the production of 44Sc with minimal impurities of the longer half-life 44mSc and to develop a simple chemical procedure for separation of 44Sc from the calcium target.

Methods: In the present work, we used highly enriched 44CaCO3 (Isoflex, Russia). The irradiations have been performed with the Scanditronix MC 40 Cyclotron of the Joint Research Centre (Ispra, Italy). Designed aluminum capsules were filled with 2 mg of dry 44CaCO3 powder, inserted into a water cooled target holder and were irradiated at different beam proton energies. For each of the irradiation, a Ti foil was used as a proton beam energy monitor. The activity of the different samples were measured with high resolution □-ray spectrometry.
Longer-lived 46Sc was used instead of 44Sc in the separation procedure. The CaCO3 target was dissolved in 1 ml of 0.1 M HCl. Then, the solution was passed through a column filled with iminodiacetic resin Chelex-100. After adsorption of 46Sc the column was washed with 30 ml of 0.01 M HCl and the effluent containing enriched calcium was collected for further irradiations. The 46Sc was quantitatively eluted with 1 M HCl in the second 0.5 ml fraction.

Results: The 44CaCO3 target was irradiated by protons in the range of 5.5-23MeV. The analysis of several irradiations indicate that the amount of 44Sc reached the maximum, with the lowest production (0.16%) of 44mSc impurity in the energy range of 9-10MeV.
46Sc was separated from the target on iminodiacetic resin with efficiency of more than 95%, eluted in volume of 0.5 ml. The recovery of the calcium target is nearly quantitative. The level of Ca2+ in 46Sc fraction is less than3 □g/ml.

Conclusions: The low-energy irradiation of 44Ca gives opportunity to produce Ci level activities of 44Sc. The separation process proposed of 44Sc from the target is simple and fast. The 44Sc obtained can be used instead of 68Ga in PET diagnosis and planning radionuclide receptor therapy..

Research Support: This work was carried out as a part of the project of the Ministry of Science and Higher Education of Poland DWM/N166/COST/2007 and COST Action D38.

References: [1] A.Majkowska, A.Bilewicz, (2011), J.Inorg.Biochem. 105, 313–320.

Author: Prof. BILEWICZ, Aleksander (Institute of Nuclear Chemistry and Technology)

Co-authors: Ms KASPEREK, Agata (Institute of Nuclear Chemistry and Technology); Dr SIMONELL, Federica (European Commission, Joint Research Centre, Institute for Health and Consumer Protection, Ispra Italy); Ms

CYDZIK, Izabela (European Commission, Joint Research Centre, Institute for Health and Consumer Protection, Ispra Italy); Dr ABBAS, Kamel (European Commission, Joint Research Centre, Institute for Health and Consumer Protection, Ispra Italy); Mr KRAJEWSKI, Seweryn (Institute of Nuclear Chemistry and Technology)

Presenter: Prof. BILEWICZ, Aleksander (Institute of Nuclear Chemistry and Technology)

Session Classification: Session 12

Track Classification: Radiopharmaceuticals Chemistry